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(54) **RECHARGEABLE BATTERY**

(75) Inventor: **Soo-Mi Eo**, Yongin-si (KR)

(73) Assignee: **Samsung SDI Co., Ltd.**, Yongin-si (KR)

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H01M 10/36 (2010.01)

(52) **U.S. Cl.**
USPC **429/94**; 429/120; 429/185

(58) **Field of Classification Search**
None
See application file for complete search history.

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Primary Examiner — John S Maples

(74) *Attorney, Agent, or Firm* — Christie, Parker & Hale, LLP

(57) **ABSTRACT**

A rechargeable battery including an electrode assembly including a positive electrode, a negative electrode, and a separator between the positive electrode and the negative electrode; a case housing the electrode assembly; a heat dissipating member including a heat collecting portion inserted in the electrode assembly and a heat dissipating portion protruding outside of the case; and a sealing member between the heat dissipating member and the case, the sealing member including a first polymer layer and a second polymer layer having a melting point that is lower than a melting point of the first polymer layer.

20 Claims, 11 Drawing Sheets

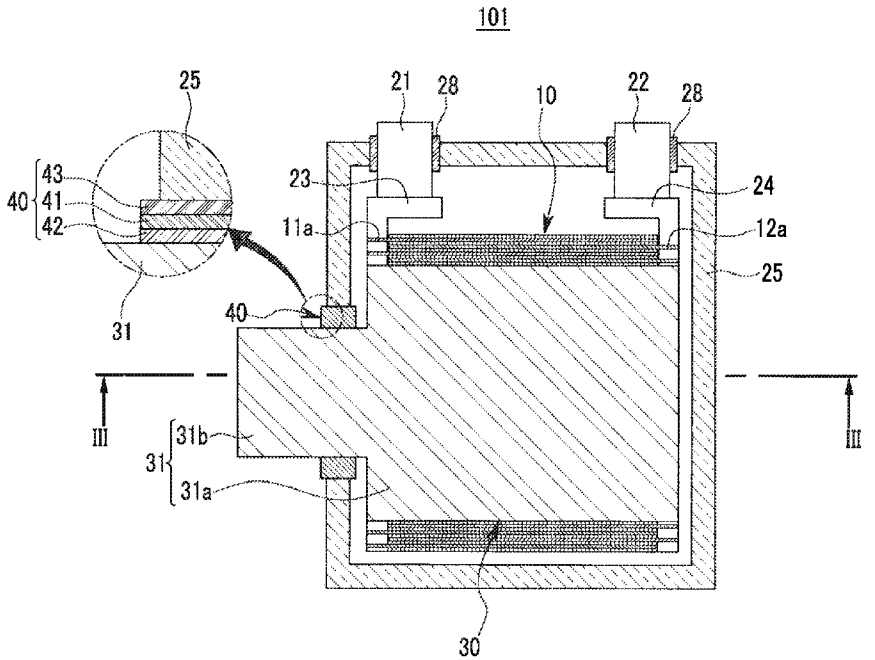


FIG.1

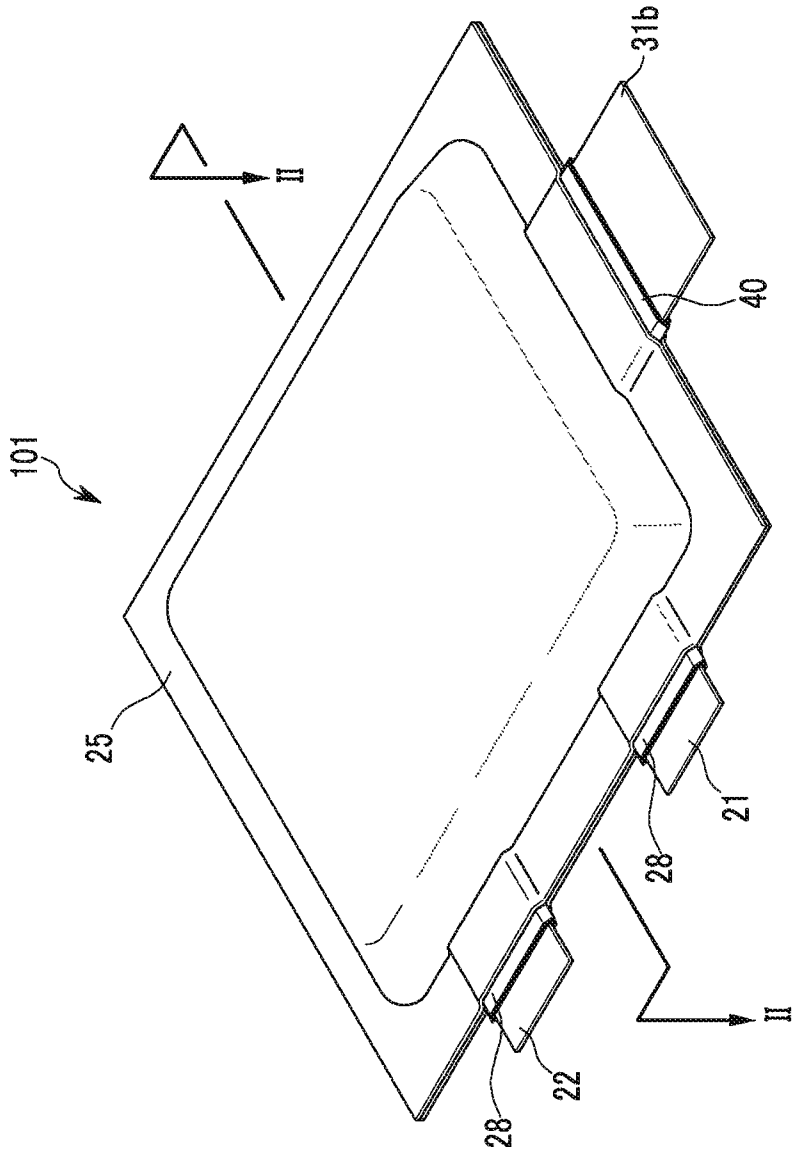


FIG.2

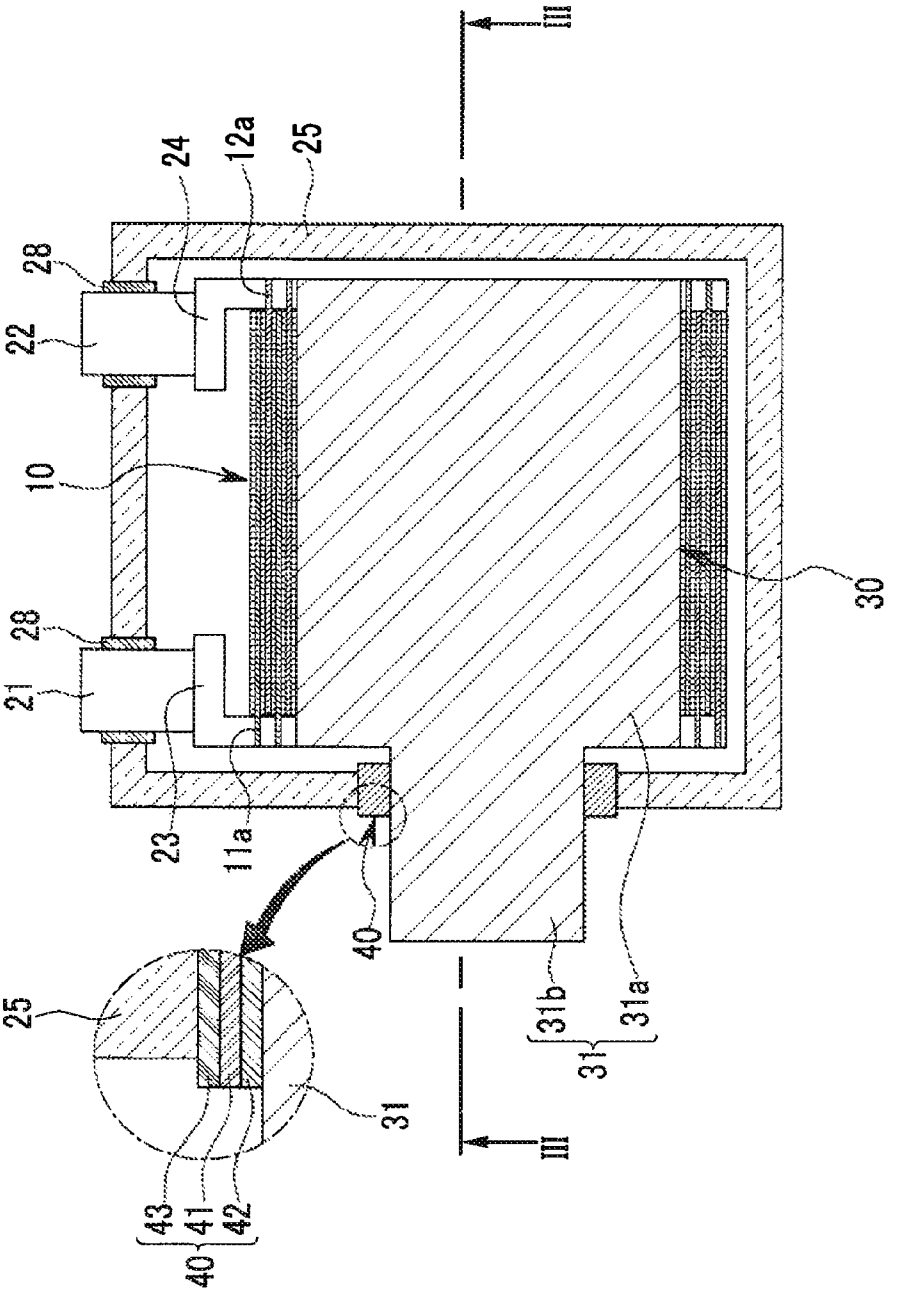

101
III
III
24
12a
25
28
22
10
28
21
23
11a
40
30
31b
31a
31
25
31
43
41
42
40

FIG.3

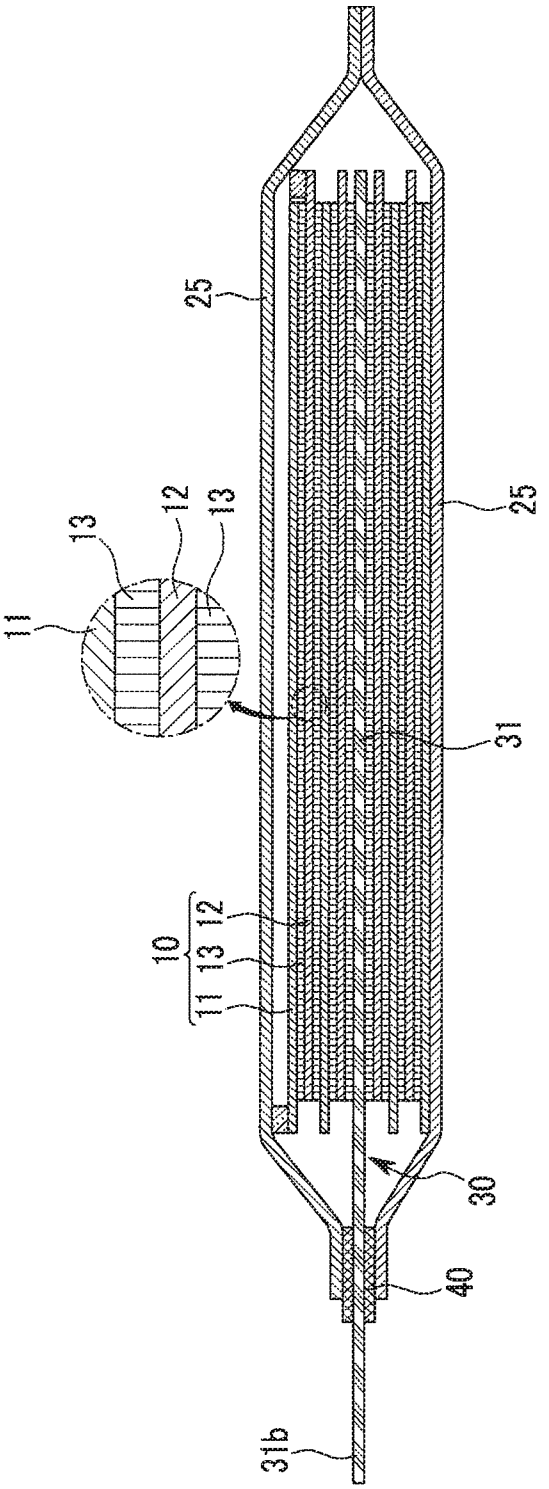


FIG.4

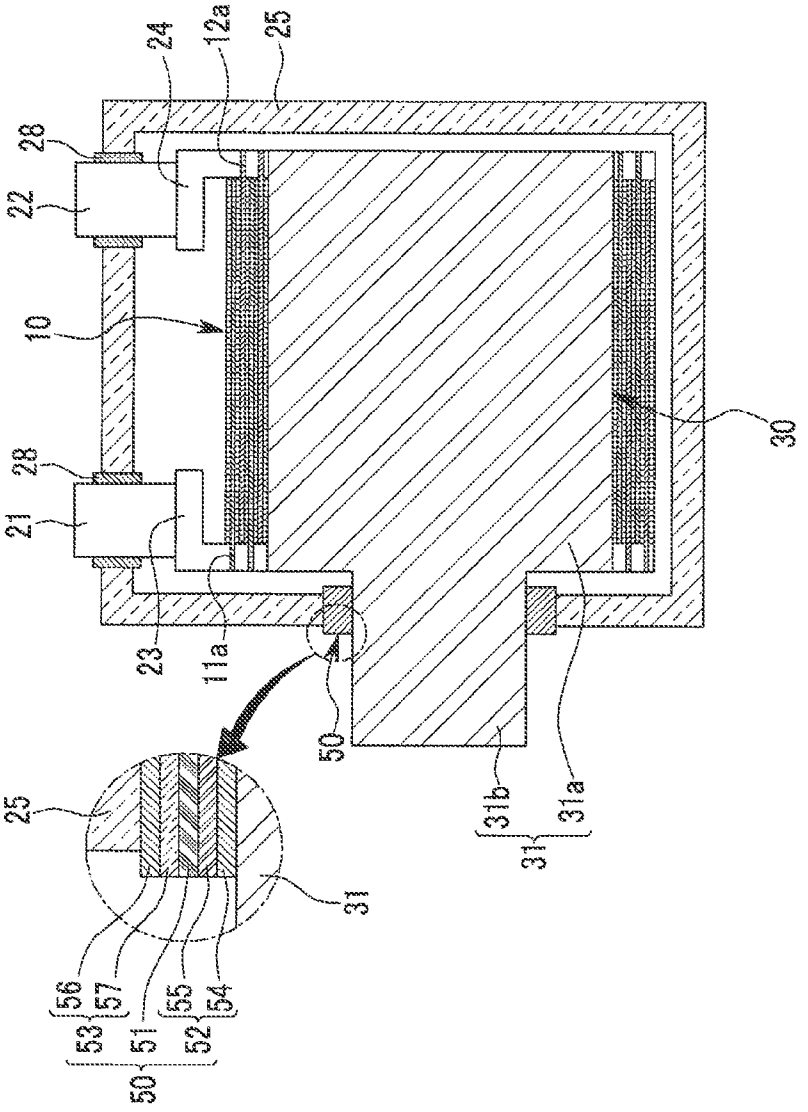

102
24
12a
25
28
22
10
28
21
23
11a
50
30
31b
31a
31
25
31
56
57
53
55
54
51
52
50

FIG.5

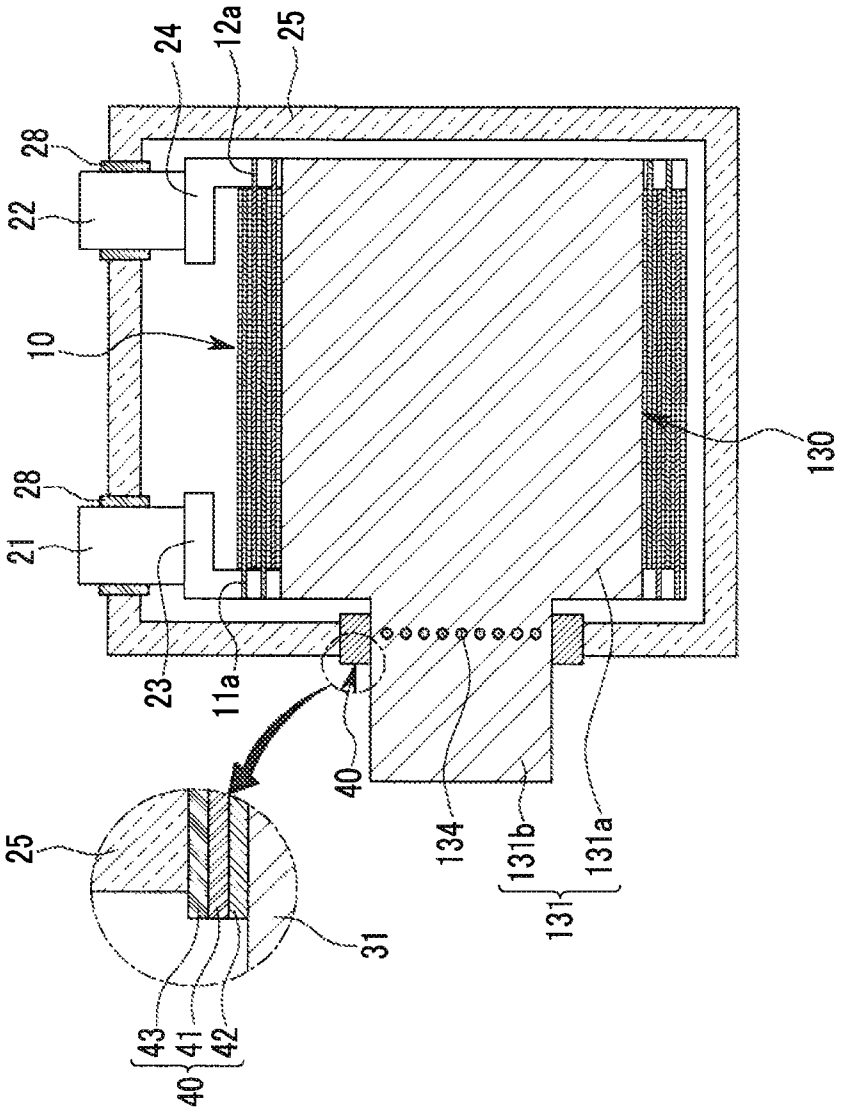

103
24
12a
25
28
22
10
28
21
23
11a
40
130
134
131b
131a
131
25
31
43
41
42
40

FIG.6

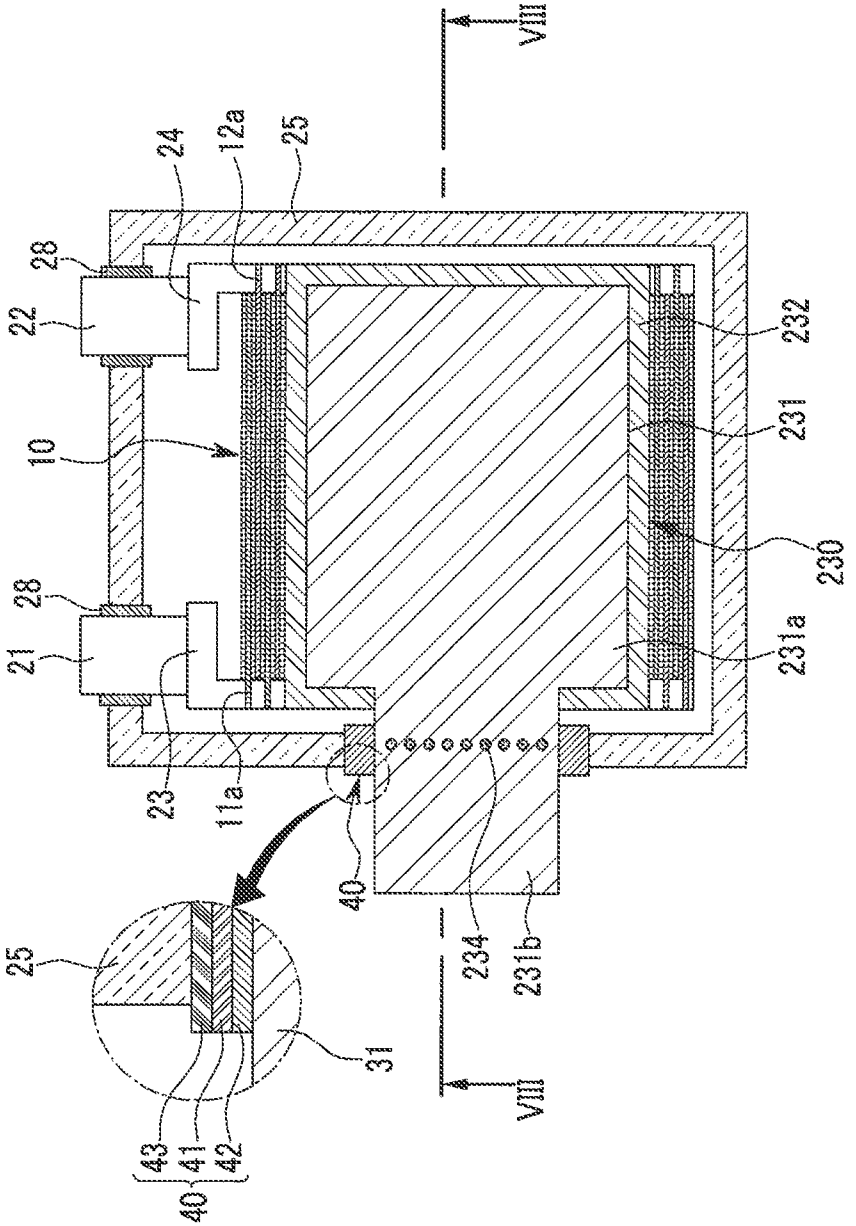

104
VIII
24
12a
25
28
22
10
28
21
23
11a
40
232
231
230
231a
234
231b
VIII
25
31
43
41
42
40

FIG.7

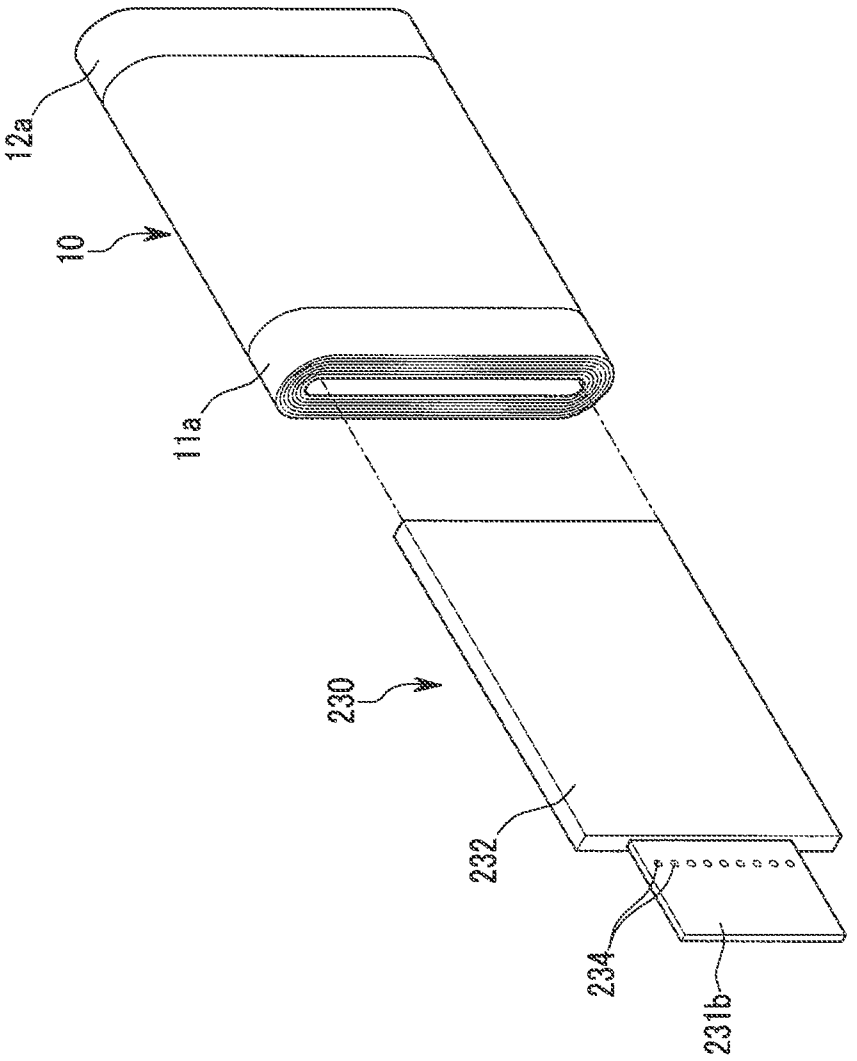


FIG.8

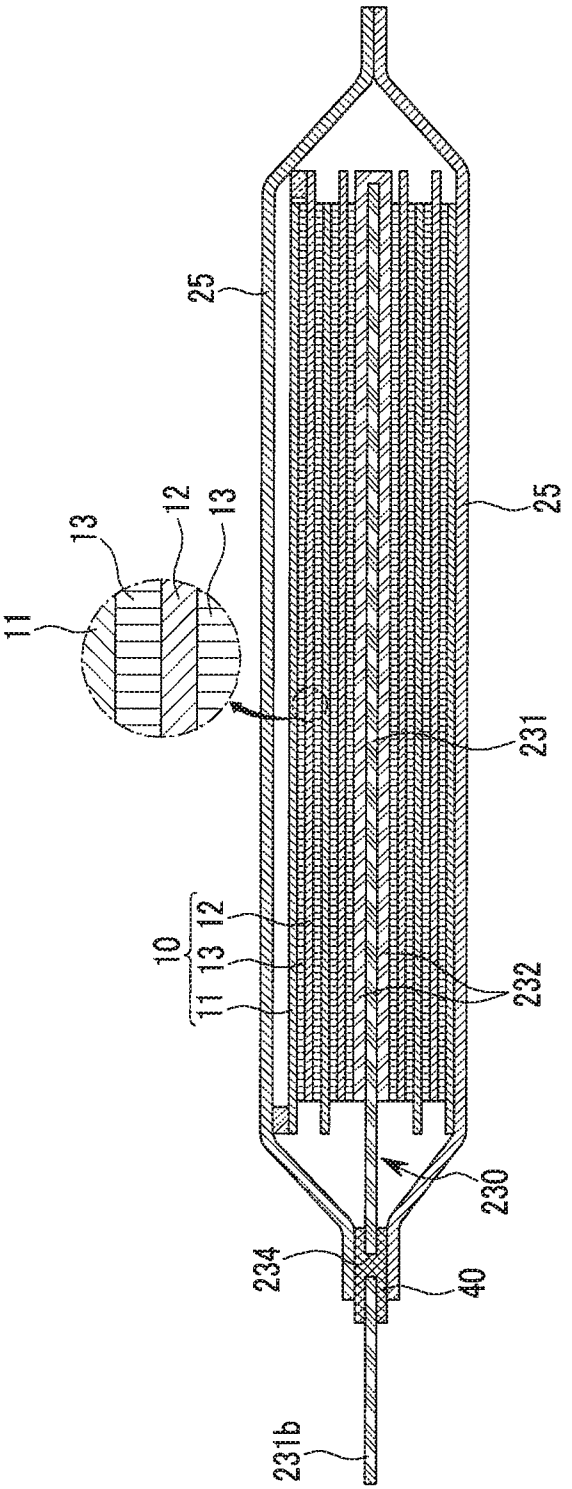


FIG.9

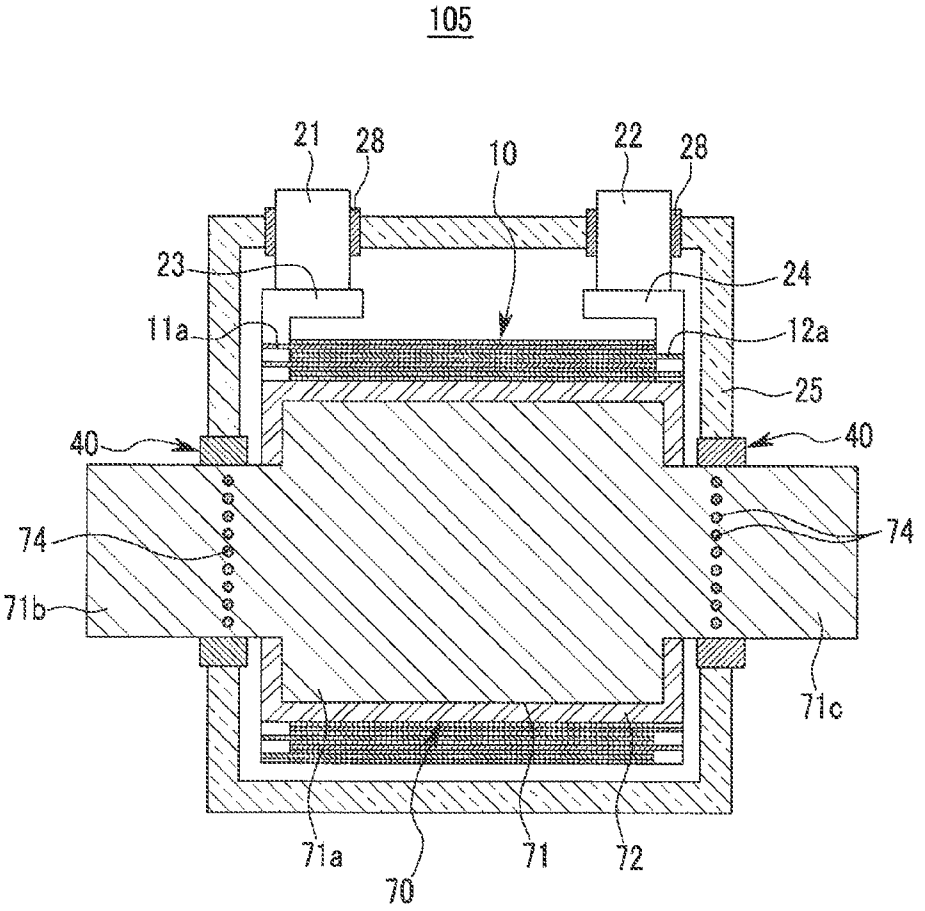


FIG.10

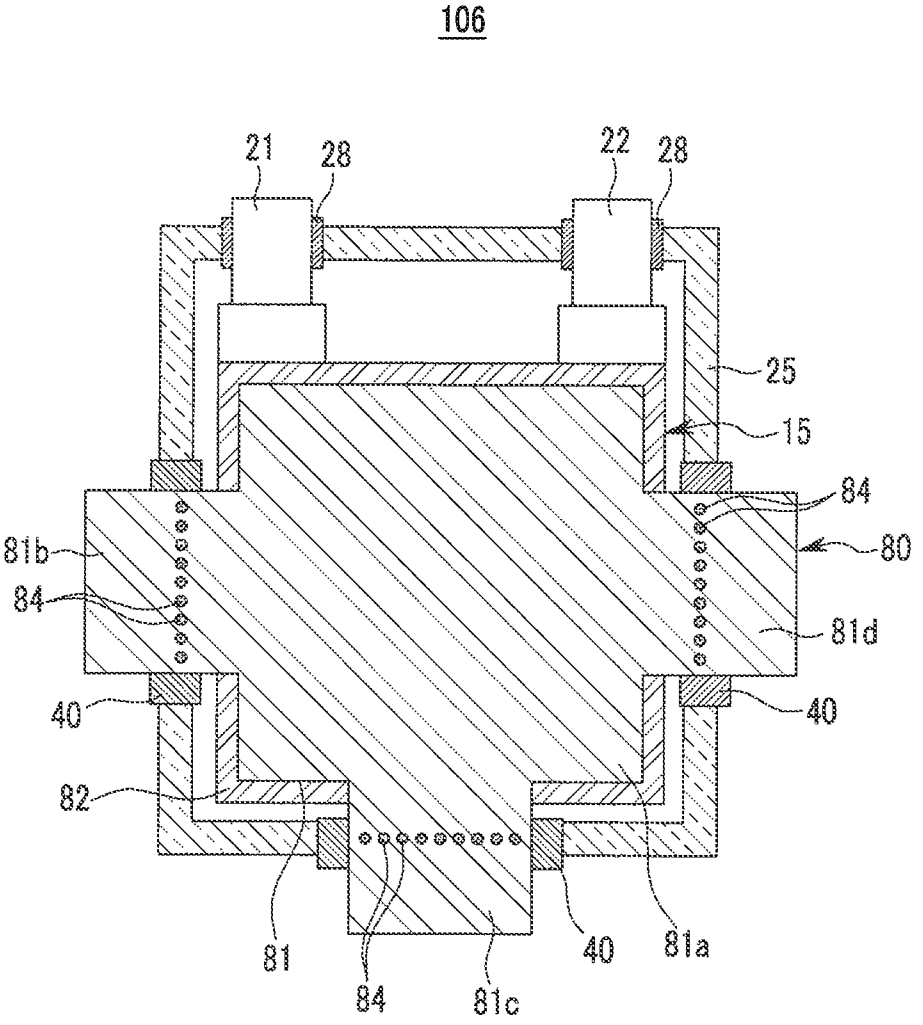
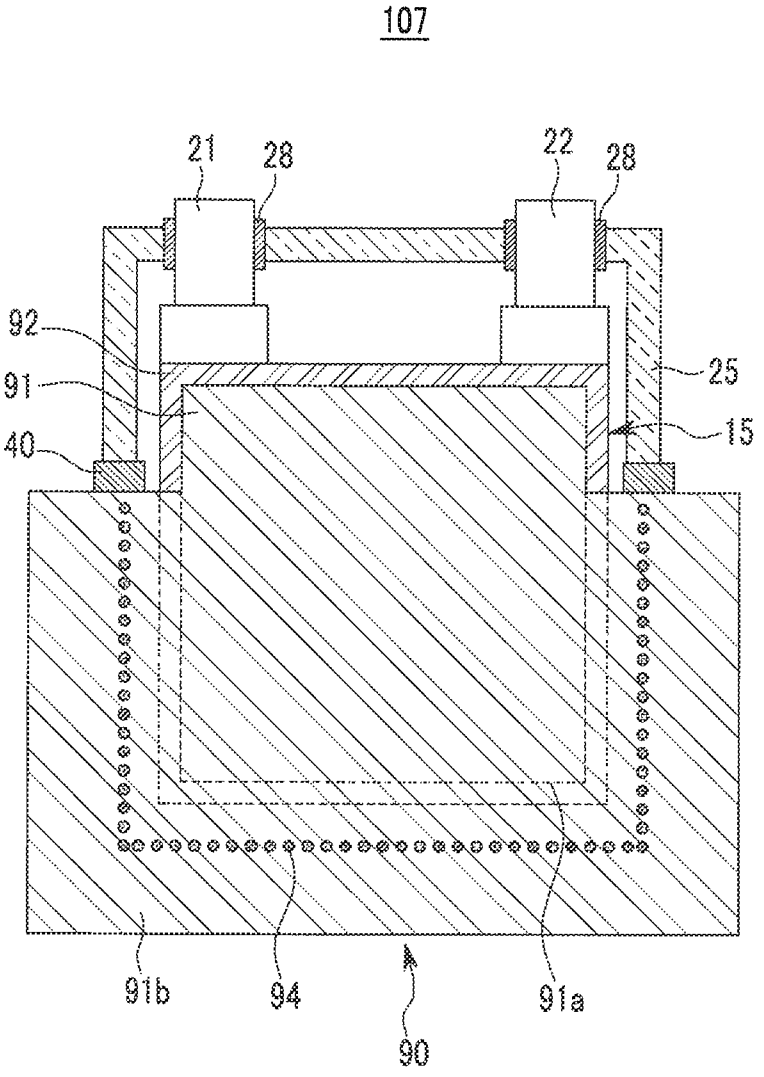


FIG.11



RECHARGEABLE BATTERY

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of Korean Patent Application No. 10-2010-0036088 filed in the Korean Intellectual Property Office on Apr. 19, 2010, the entire content of which is incorporated herein by reference.

BACKGROUND

1. Field

Aspects of embodiments of the present invention relate to a rechargeable battery, and more particularly, to a rechargeable battery having a sealing structure of a heat dissipating member that is installed within an electrode assembly.

2. Description of the Related Art

A rechargeable battery can be recharged and discharged, unlike a primary battery that cannot be recharged. A low-capacity rechargeable battery is commonly used for a small portable electronic device, such as a mobile phone, a laptop computer, or a camcorder, and a large-capacity rechargeable battery is widely used as a power source for driving a motor, such as for a hybrid vehicle, and a battery for storing power.

A large-capacity, high-power rechargeable battery using high energy density of a non-aqueous electrolyte has been developed, and such a large-capacity, high-power rechargeable battery is formed with a high-output battery module in which a plurality of rechargeable batteries for driving a device requiring a large amount of electric power, such as a motor of an electric vehicle, are coupled in series.

Further, such a rechargeable battery can be formed in a cylindrical shape, a quadrangular shape, a pouch type, etc.

While the rechargeable battery is charged and discharged, much heat is generated within the rechargeable battery, and it is very important to effectively emit such heat. When the internal temperature of the rechargeable battery is high, an abnormal reaction occurs and thus the life-span of the rechargeable battery is deteriorated, and when the temperature thereof continues to rise, the rechargeable battery may ignite or explode.

Further, it is very important to stably seal a case of the rechargeable battery in order to prevent leakage of an electrolyte solution, and in a process of heat pressing a case of a pouch type rechargeable battery, as a melted polymer is excessively deformed, when a polymer layer is non-uniformly formed, a problem that sealing is not appropriately performed occurs. Where sealing is not appropriately performed, when the electrolyte solution leaks, the rechargeable battery may be short-circuited or ignited due to the leaked electrolyte solution.

Further, while the electrode assembly repeats charge and discharge, the volume thereof may expand or it may be deformed, and when the shape of the electrode assembly is deformed, a problem of charge and discharge efficiency being deteriorated occurs.

The above information disclosed in this Background section is only for enhancement of understanding of the background of the described technology and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

According to aspects of embodiments of the present invention, a rechargeable battery has improved safety.

According to an exemplary embodiment of the present invention, a rechargeable battery includes: an electrode assembly including a positive electrode, a negative electrode, and a separator between the positive electrode and the negative electrode; a case housing the electrode assembly; a heat dissipating member including a heat collecting portion inserted in the electrode assembly and a heat dissipating portion protruding outside of the case; and a sealing member between the heat dissipating member and the case, the sealing member including a first polymer layer and a second polymer layer having a melting point that is lower than a melting point of the first polymer layer.

In one embodiment, the electrode assembly has a spiral-wound structure, and the heat dissipating member is inserted in a center of the electrode assembly.

In one embodiment, the heat dissipating member has a hole formed in a portion contacting the sealing member. A portion of the sealing member may be in the hole.

In one embodiment, the second polymer layer includes polypropylene.

The second polymer layer may include a first sealing layer including polypropylene and a second sealing layer including cast polypropylene.

The first polymer layer and the second polymer layer may be stacked.

In one embodiment, the sealing member further includes a third polymer layer having a melting point that is lower than the melting point of the first polymer layer, and the first polymer layer is disposed between the second polymer layer and the third polymer layer. The third polymer layer may include a third sealing layer including polypropylene and a fourth sealing layer including cast polypropylene. The fourth sealing layer may be between the third sealing layer and the first polymer layer.

The first polymer layer may include an imide-based resin. The first polymer layer may include a material selected from the group consisting of polyimide, polyamideimide, polyetherimide, and polybismaleimide.

The melting point of the first polymer layer may be at least 20° C. higher than the melting point of the second polymer layer. In one embodiment, the sealing member is hot pressed.

In one embodiment, the heat dissipating member includes a metal plate.

The heat dissipating member may further include an interception layer covering a surface of the heat collecting portion.

In one embodiment, the rechargeable battery further includes a terminal protruding outside of the case in a first direction, and the heat dissipating portion is protruding outside of the case in a different direction than the first direction.

In one embodiment, the heat dissipating portion is a first heat dissipating portion, and the heat dissipating member further includes a second heat dissipating portion protruding outside of the case in a direction opposite a direction in which the first heat dissipating portion is protruding outside of the case. The heat dissipating member may further include a third heat dissipating portion protruding outside of the case in a direction intersecting the directions in which the first and second heat dissipating portions are protruding outside of the case.

In one embodiment, the heat dissipating portion is connected to and protruding outside of the case along three surfaces of the case.

According to an aspect of embodiments of the present invention, a sealing portion that seals between a case and a heat dissipating member includes a first polymer layer and a

second polymer layer having different melting points, and sealing between the case and the heat dissipating member can be stably performed.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of embodiments of the present invention will become more apparent to those of ordinary skill in the art by describing in detail some exemplary embodiments of the present invention with reference to the attached drawings.

FIG. **1** is a perspective view of a rechargeable battery according to an exemplary embodiment of the present invention.

FIG. **2** is a cross-sectional view of the rechargeable battery of FIG. **1** taken along line II-II.

FIG. **3** is a cross-sectional view of the rechargeable battery of FIG. **1** taken along line III-III of FIG. **2**.

FIG. **4** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

FIG. **5** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

FIG. **6** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

FIG. **7** is an exploded perspective view of an electrode assembly and a heat dissipating member of the rechargeable battery of FIG. **6**.

FIG. **8** is a cross-sectional view of the rechargeable battery of FIG. **6** taken along line VIII-VIII.

FIG. **9** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

FIG. **10** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

FIG. **11** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

Description of Reference Numerals Indicating Some Elements in the Drawings

101, 102, 103, 104, 105, 106, 107: rechargeable battery	
10, 15: electrode assembly	
11: positive electrode	11a: positive uncoated portion
12: negative electrode	12a: negative uncoated portion
13: separator	21: positive terminal
22: negative terminal	23: positive current collecting tap
24: negative current collecting tap	25: case
30, 70, 80, 90, 130, 230: heat dissipating member	
31, 71, 81, 91, 131, 231: metal plate	
31a, 71a, 81a, 91a, 131a, 231a: heat collecting portion	
31b, 91b, 131b, 231b: heat dissipating portion	
71b, 81b: first heat dissipating portion	
71c, 81c: second heat dissipating portion	81d: third heat dissipating portion
72, 82, 92, 232: interception layer	74, 84, 94, 134, 234: hole
40, 50: sealing member	41, 51: first polymer layer
42, 52: second polymer layer	43, 53: third polymer layer
54: first sealing layer	55: second sealing layer
56: third sealing layer	57: fourth sealing layer

DETAILED DESCRIPTION

In the following detailed description, some exemplary embodiments of the present invention are shown and described, by way of illustration. As those skilled in the art would realize, the described exemplary embodiments may be modified in various ways without departing from the spirit or scope of the present invention. Rather, these exemplary embodiments are provided by way of example for understanding of the invention and to convey the scope of the invention to those skilled in the art. Like reference numerals designate like elements throughout the specification and the drawings.

FIG. **1** is a perspective view of a rechargeable battery according to an exemplary embodiment of the present invention, and FIG. **2** is a cross-sectional view taken along line II-II of FIG. **1**.

Referring to FIGS. **1** and **2**, a rechargeable battery **101** includes an electrode assembly **10** that performs charge and discharge, and a case **25** that houses the electrode assembly **10**.

The case **25** forms an exterior of the rechargeable battery **101** and provides a space in which the electrode assembly **10** is contained. The case **25** is formed in a pouch type that is formed with a film.

In one embodiment, a positive terminal **21** and a negative terminal **22** are electrically connected to the electrode assembly **10**, and the positive terminal **21** and the negative terminal **22** are protruded to the outside of the case **25**.

In one embodiment, the positive terminal **21** is electrically connected to a positive uncoated portion **11***a* of the electrode assembly **10** through a positive current collecting tab **23**, and the negative terminal **22** is electrically connected to a negative uncoated portion **12***a* of the electrode assembly **10** through a negative current collecting tab **24**. The positive terminal **21** and the negative terminal **22** are protruded to the outside of the case **25**, and an insulation layer **28** for insulating and sealing is installed between the positive terminal **21** and the case **25**, and between the negative terminal **22** and the case **25**. The positive terminal **21** and the negative terminal **22**, according to one exemplary embodiment, are protruded in the same direction from the case **25**; however, the present invention is not limited thereto and, in another embodiment, the positive terminal **21** and the negative terminal **22** may be protruded in opposite directions.

As shown in FIGS. **2** and **3**, the electrode assembly **10** includes a positive electrode **11**, a negative electrode **12**, and a separator **13** that is disposed between the positive electrode **11** and the negative electrode **12**. The electrode assembly **10**, in one embodiment, is formed in a structure in which the positive electrode **11** and the negative electrode **12** are formed in a belt shape and are spirally wound with the separator **13** interposed therebetween.

The positive uncoated portion **11***a*, at which a positive electrode active material is not coated, is formed at one side in the width direction of the positive electrode **11**, and the negative uncoated portion **12***a*, at which a negative electrode active material is not coated, is formed at one side in the width direction of the negative electrode **12**. In one embodiment, as shown in FIG. **2**, the positive uncoated portion **11***a* and the negative uncoated portion **12***a* are formed at opposite sides of the electrode assembly **10**.

A heat dissipating member **30** that emits heat generated in the electrode assembly **10** to the outside is inserted into the electrode assembly **10**, such as at the center of the electrode assembly **10**. In one embodiment, the heat dissipating member **30** is formed of a metal plate **31**, and the metal plate **31** includes a heat collecting portion **31***a* that is positioned within the case **25** and that is formed in an approximately quadrangular plate structure and a heat dissipating portion

31*b* that is protruded from the heat collecting portion **31***a* and exposed to the outside of the case **25**.

The heat dissipating portion **31***b*, in one embodiment, is protruded outside of the case **25** in a different direction from the protruding direction of the terminals **21** and **22**, and the heat dissipating portion **31***b* according to one exemplary embodiment is protruded from a side surface intersecting a side surface of the case **25** in which the terminals **21** and **22** are protruded. When the heat dissipating portion **31***b* is protruded in a different direction from a protruding direction of the terminals **21** and **22**, the heat dissipating portion **31***b* can easily emit heat without interference of the terminals **21** and **22**.

A sealing member **40** for sealing is installed between the case **25** and the heat dissipating member **30**. The sealing member **40** is formed in a multi-layered structure, and includes a first polymer layer **41**, a second polymer layer **42**, and a third polymer layer **43** having a lower melting point than the first polymer layer **41**. In one embodiment, the first polymer layer **41** is disposed between the second polymer layer **42** and the third polymer layer **43**.

The first polymer layer **41**, in one embodiment, has a melting point that is at least 20° C. higher than a melting point of the second polymer layer **42** and a melting point of the third polymer layer **43**. In one embodiment, a melting point of the first polymer layer is 20° C. to 300° C. higher than a melting point of the second polymer layer. As used herein, the melting point refers to a temperature at which heat decomposition starts.

If the melting point difference between the first polymer layer **41** and the second and third polymer layers **42** and **43** is less than 20° C., in a thermal adhesion process, the first polymer layer **41** is melted together and thus a problem that the sealing member **40** is not supported and is deformed occurs. When the sealing member **40** is deformed, the thickness of the sealing member **40** is not uniform, and thus the sealing performance between the heat dissipating member **30** and the case **25** is deteriorated.

In one embodiment, the second polymer layer **42** and the third polymer layer **43** are formed of a polypropylene layer or a cast polypropylene layer. Polypropylene has a melting point of about 160° C. In one exemplary embodiment, the second polymer layer **42** and the third polymer layer **43** are made of the same material, but the present invention is not limited thereto, and when the second polymer layer **42** and the third polymer layer **43** have a lower melting point than the first polymer layer **41**, the second polymer layer **42** and the third polymer layer **43** may be made of other materials having different melting points.

The first polymer layer **41**, in one embodiment, is made of a thermal resistance polymer material having a melting point of 180° C. or more. In one exemplary embodiment, the first polymer layer **41** may be made of an imide-based resin, such as polyimide, polyamideimide, polyetherimide, or polybismaleimide. A heat decomposition start temperature of a polyimide is generally about 450° C., and thus the first polymer layer **41** has very strong thermal resistance, thereby capable of enduring high heat, compared with the second polymer layer **42** and the third polymer layer **43**.

The sealing member **40** is connected along the circumference of the heat dissipating portion **31***b* and is heat pressed to be attached to the heat dissipating member **30** and the case **25**. When the sealing member **40** is heat pressed, the plurality of layers are fused to seal the case **25**.

Particularly, because the first polymer layer **41** is positioned between the second polymer layer **42** and the third polymer layer **43**, the second polymer layer **42** and the third polymer layer **43** having a relatively low melting point are melted and thus the sealing property is improved, and because the first polymer layer **41** supports pressure in an initial stage, the form, or shape, of the sealing member **40** can be sustained and the sealing member **40** is stably pressed to closely contact the case **25** and the heat dissipating member **30**.

In an exemplary embodiment, when the heat dissipating member **30** having the heat collecting portion **31***a* and the heat dissipating portion **31***b* is installed, the shape of the electrode assembly **10** can be stably sustained, and heat that is generated within the electrode assembly **10** can be collected in the heat collecting portion **31***a* and can be emitted from the heat dissipating portion **31***b* that, in one embodiment, is integrally formed with the heat collecting portion **31***a*, to the outside of the case **25**. Accordingly, by thus emitting heat generated within the rechargeable battery **101**, the temperature of the rechargeable battery **101** is prevented or substantially prevented from excessively rising and, thus, safety of the rechargeable battery **101** is improved.

FIG. **4** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention.

Referring to FIG. **4**, a rechargeable battery **102** according to one exemplary embodiment of the present invention is formed having the same or substantially the same structure as the rechargeable battery **101** described above, except for the structure of a polymer layer, and therefore a detailed description of the other same or similar components thereof will be omitted.

In the rechargeable battery **102**, a sealing member **50** for sealing is installed between the case **25** and the heat dissipating member **30**. The sealing member **50** is formed in a multi-layered structure and includes a first polymer layer **51**, a second polymer layer **52** that is stacked to contact one surface of the first polymer layer **51** and that has a lower melting point than the first polymer layer **51**, and a third polymer layer **53** that is stacked to contact an opposite surface of the first polymer layer **51** and that has a lower melting point than the first polymer layer **51**.

The second polymer layer **52** includes a first sealing layer **54** that is made of polypropylene and a second sealing layer **55** that is made of cast polypropylene. Further, the third polymer layer **53** includes a third sealing layer **56** that is made of polypropylene and a fourth sealing layer **57** that is made of cast polypropylene.

The first sealing layer **54** is positioned between the second sealing layer **55** and the metal plate **31**, and the second sealing layer **55** is positioned between the first sealing layer **54** and the first polymer layer **51**. Further, the third sealing layer **56** is positioned between the fourth sealing layer **57** and the case **25**, and the fourth sealing layer **57** is positioned between the third sealing layer **56** and the first polymer layer **51**.

The first sealing layer **54**, the second sealing layer **55**, the first polymer layer **51**, the fourth sealing layer **57**, and the third sealing layer **56** are sequentially stacked on the metal plate **31**, and these layers are heat pressed to form the sealing member **50**.

In one embodiment, a melting point of the first polymer layer **51** is at least 20° C. higher than a melting point of the second polymer layer **52** and a melting point of the third polymer layer **53**. In one embodiment, a melting point of the first polymer layer is 20° C. to 300° C. higher than a melting point of the secondary polymer layer.

If the melting point difference between the first polymer layer **51** and the second polymer layer **52** and the third polymer layer **53** is less than 20° C., in a thermal adhesion process, the first polymer layer **51** is melted together and a problem

occurs of the form thereof being deformed. When the first polymer layer **51** is deformed, the thickness of the sealing member **50** is not uniform and, thus, sealing performance between the heat dissipating member **30** and the case **25** is deteriorated.

In one embodiment, polypropylene constituting the second polymer layer **52** and the third polymer layer **53** has a melting point of about 160° C., and the first polymer layer **51** is made of a thermal resistance polymer material having a melting point of 180° C. or higher.

In one exemplary embodiment, the first polymer layer **51** is made of an imide-based resin, such as polyimide, polyamideimide, polyetherimide, or polybismaleimide. The heat decomposition start temperature of a polyimide is generally about 450° C., and thus the first polymer layer **51** has a strong thermal resistance and is capable of enduring high heat, compared with the second polymer layer **52** and the third polymer layer **53**.

The sealing member **50** is connected along the circumference of the heat dissipating portion **31***b* and is heat pressed to be attached to the heat dissipating member **30** and the case **25**. When the sealing member **50** is heat pressed, a plurality of layers are fused to seal the case **25**. Particularly, because the first sealing layer **54**, the third sealing layer **56**, the second sealing layer **55**, and the fourth sealing layer **57** are formed at the outside of the first polymer layer **51**, the second polymer layer **52** and the third polymer layer **53** having a relatively low melting point are melted and the sealing property is improved, and because the first polymer layer **51** supports pressure in an initial stage, the form of the sealing member **50** can be sustained and the sealing member **50** may be stably pressed to closely contact the case **25** and the heat dissipating member **30**.

FIG. **5** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention. Referring to FIG. **5**, a rechargeable battery **103** according to one exemplary embodiment of the present invention is formed having the same or substantially the same structure as that of the rechargeable battery **101** described above, except for the structure of a heat dissipating member **130**, and therefore a detailed description of the other same or similar components thereof will be omitted.

The heat dissipating member **130** according to an exemplary embodiment is inserted into the electrode assembly **10**, and has a metal plate **131** that is protruded to the outside of the case **25**. The metal plate **131** includes a heat collecting portion **131***a* that is positioned within the case **25** and that is formed as an approximately quadrangular plate structure, and a heat dissipating portion **131***b* that is protruded from the heat collecting portion **131***a* and exposed to the outside of the case **25**.

Further, in the heat dissipating portion **131***b*, a plurality of holes **134** are formed in a portion contacting the sealing member **40**, and the sealing member **40** is inserted into the holes **134**. The plurality of holes **134** are separated in one direction in a portion in which the sealing member **40** is installed. In one embodiment, each of the holes **134** is formed having a circular shape, but the shape of the holes **134** is not limited thereto and, in other embodiments, may be formed in various shapes or combinations of shapes, such as triangular or quadrangular shapes.

Due to the holes **134** and the sealing member **40** being inserted therein, the heat dissipating portion **131***b* is configured to be fixed by the sealing member **40** to prevent or substantially prevent the heat dissipating member **130** from moving. Because the heat dissipating portion **131***b* is exposed to the outside of the case **25**, an external impact or vibration may be transferred to the heat dissipating portion **131***b*. Further, if the heat dissipating portion **131***b* were to move due to an external impact or vibration, a gap might occur between the heat dissipating portion **131***b* and the sealing member **40** and the problem of sealing performance being deteriorated could occur. However, in the described exemplary embodiment of the present invention, when forming the hole **134** in the heat dissipating portion **131***b* and inserting the sealing member **40** into the hole **134**, the sealing member **40** and the heat dissipating portion **131***b* are integrally fixed and, thus, the problem of a gap occurring between the heat dissipating portion **131***b* and the sealing member **40**, such as due to external impact or vibration, is prevented or substantially prevented.

FIG. **6** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention, FIG. **7** is an exploded perspective view illustrating an electrode assembly and a heat dissipating member of the rechargeable battery of FIG. **6**, and FIG. **8** is a cross-sectional view of the rechargeable battery of FIG. **6**, taken along line VIII-VIII.

With reference to FIGS. **6-8**, a rechargeable battery **104** according to an exemplary embodiment of the present invention has the same or substantially the same structure as that of the rechargeable battery **101**, except for the structure of a heat dissipating member **230**, and therefore a detailed description of the other same or similar components thereof will be omitted.

The heat dissipating member **230** according to one exemplary embodiment includes a metal plate **231** that is inserted into the electrode assembly **10** and is protruded to the outside of the case **25**, and an interception layer **232** that encloses the metal plate **231** and is formed of a polymer.

The electrode assembly **10**, in one embodiment, is formed by winding in a state where a separator is interposed between a positive electrode and a negative electrode, as described above with respect to the electrode assembly **10** of the rechargeable battery **101**. In one embodiment, the metal plate **231** includes a heat collecting portion **231***a* that is positioned within the case **25** and that is formed in an approximately quadrangular plate structure, and a heat dissipating portion **231***b* that is protruded from the heat collecting portion **231***a* and exposed to the outside of the case **25**.

The interception layer **232** covers the heat collecting portion **231***a*, and the interception layer **232** is not formed in the heat dissipating portion **231***b*. The interception layer **232** is formed of a thin film in order to easily transfer heat to the heat collecting portion **231***a*. The heat dissipating portion **231***b*, in one embodiment, is protruded in a different direction from a protruding direction of the terminals **21** and **22**. Further, in one embodiment, in the heat dissipating portion **231***b*, a plurality of holes **234** are formed in a portion contacting the sealing member **40**, and the sealing member **40** is inserted into the holes **234**.

In the rechargeable battery **104**, when the heat dissipating member **230** having the heat collecting portion **231***a* and the heat dissipating portion **231***b* is installed, the shape of the electrode assembly **10** can be stably sustained, and heat that is generated within the electrode assembly **10** is collected in the heat collecting portion **231***a* and emitted from the heat dissipating portion **231***b* that, in one embodiment, is integrally formed with the heat collecting portion **231***a* to the outside. Accordingly, by easily emitting heat that is generated within the rechargeable battery **104**, the temperature of the rechargeable battery **104** is prevented or substantially prevented from excessively rising and, thus, safety of the rechargeable battery **104** is improved.

Further, because the heat dissipating member **230** of the rechargeable battery **104** includes the interception layer **232** that covers the metal plate **231**, an electrolyte solution and the metal plate **231** can be prevented or substantially prevented from reacting.

While repeating charge and discharge, when the electrode assembly **10** is deformed by expanding, a gap between the electrodes may be extended. If the gap between the electrodes is extended, the moving distance between ions and electrons is extended and thus charge and discharge efficiency is reduced. However, according to exemplary embodiments described herein, because the heat dissipating member **230** supports the form of the electrode assembly **10**, the electrode assembly **10** can be prevented or substantially prevented from being deformed.

FIG. **9** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention. Referring to FIG. **9**, a rechargeable battery **105** according to an exemplary embodiment is formed having a same or similar structure to that of the rechargeable battery **101** described above, except for the structure of a heat dissipating member **70**, and therefore a detailed description of the other same or similar components thereof will be omitted.

The heat dissipating member **70** according to one exemplary embodiment is inserted into the electrode assembly **10**, and includes a metal plate **71** and an interception layer **72** that encloses the metal plate **71**. The electrode assembly **10** is formed by winding in a state where a separator is interposed between a positive electrode and a negative electrode, as described above with respect to the electrode assembly **10** of the rechargeable battery **101**. The metal plate **71** includes a heat collecting portion **71***a* that is positioned within the case **25** and is formed having an approximately quadrangular plate structure, and heat dissipating portions **71***b* and **71***c* that are protruded from the heat collecting portion **71***a* and exposed to the outside of the case **25**.

The heat dissipating member **70**, in one embodiment, has the first heat dissipating portion **71***b* and the second heat dissipating portion **71***c* that is protruded in a direction opposite to a protruding direction of the first heat dissipating portion **71***b*. In one embodiment, the first and second heat dissipating portions **71***b* and **71***c* are protruded to surfaces in which the terminals **21** and **22** are not installed in the case **25**, and the first and second heat dissipating portions **71***b* and **71***c* are protruded to surfaces intersecting a surface in which the terminals **21** and **22** are installed.

Further, sealing members **40** that seal between the heat dissipating portions **71***b* and **71***c* and the case **25** are installed at regions in which the heat dissipating portions **71***b* and **71***c* and the case **25** are overlapped. The sealing members **40** according to one exemplary embodiment are formed having a same or similar structure as that of the sealing member **40** described above with respect to the rechargeable battery **101**, and therefore a detailed description thereof will be omitted.

Further, in the heat dissipating portions **71***b* and **71***c*, a plurality of holes **74** are formed in a portion contacting the sealing member **40**, and the sealing member **40** is inserted into the holes **74**. The holes **74** are separated along a perimeter direction of the case **25**, and the heat dissipating member **70** is stably fixed without moving by the sealing member **40**. If the heat dissipating member **70** is moved by an external vibration or impact, the heat dissipating portions **71***b* and **71***c* may be separated from the sealing member **40** and a problem of an electrolyte solution leaking may occur. However, in the rechargeable battery **105**, because the sealing member **40** is inserted into the holes **74** that are formed in the heat dissipating portions **71***b* and **71***c*, the sealing member **40** fixes the heat dissipating portions **71***b* and **71***c* and, thus, the sealing member **40** and the heat dissipating portions **71***b* and **71***c* are prevented or substantially prevented from being separated by an external impact or vibration.

In the rechargeable battery **105**, because the two heat dissipating portions **71***b* and **71***c* are formed in the heat dissipating member **70**, heat that is absorbed in the heat collecting portion **71***a* is more easily emitted and thus heat dissipating performance is further improved.

FIG. **10** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention. Referring to FIG. **10**, a rechargeable battery **106** according to an exemplary embodiment is formed having a similar structure to that of the rechargeable battery **101** described above, and therefore a detailed description of the same or similar components thereof will be omitted.

The rechargeable battery **106** includes an electrode assembly **15** and a heat dissipating member **80** that is inserted into the electrode assembly **15**. The heat dissipating member **80** includes a metal plate **81** and an interception layer **82** that encloses the metal plate **81**. The electrode assembly **15**, in one embodiment, is a stack-type electrode assembly in which a plurality of positive electrodes and a plurality of negative electrodes are stacked with separators interposed therebetween. In one embodiment, the metal plate **81** includes a heat collecting portion **81***a* that is positioned within the case **25** and that is formed having an approximately quadrangular plate structure, and first, second, and third heat dissipating portions **81***b*, **81***c*, and **81***d* that are protruded from the heat collecting portion **81***a* and exposed to the outside of the case **25**.

The heat dissipating member **80**, according to one embodiment, has the first heat dissipating portion **81***b*, the second heat dissipating portion **81***c* that is protruded in a direction opposite to a protruding direction of the first heat dissipating portion **81***b*, and the third heat dissipating portion **81***d* that is protruded in a direction intersecting a protruding direction of the first heat dissipating portion **81***b* and the second heat dissipating portion **81***c*.

The heat dissipating portions **81***b*, **81***c*, and **81***d*, in one embodiment, are protruded from a surface in which the terminals **21** and **22** are not installed in the case **25**. In one embodiment, the first heat dissipating portion **81***b* and the second heat dissipating portion **81***c* are protruded from a surface intersecting a surface in which the terminals **21** and **22** are installed, and the third heat dissipating portion **81***d* is protruded from a surface opposite a surface in which the terminals **21** and **22** are installed.

Further, sealing members **40** that seal between the case **25** and the heat dissipating portions **81***b*, **81***c*, and **81***d* are formed at regions in which the heat dissipating portions **81***b*, **81***c*, and **81***d* and the case **25** are overlapped. The sealing members **40** according to an exemplary embodiment are formed having the same structure (i.e. having the polymer layers) as described above with respect to the rechargeable battery **101**, and therefore a detailed description thereof will be omitted.

Further, in one embodiment, in the heat dissipating portions **81***b*, **81***c*, and **81***d*, a plurality of holes **84** are formed in one or more portions contacting the sealing members **40**, and the sealing members **40** are inserted into the holes **84**. The holes **84** are separated along a perimeter direction of the case **25**, and the heat dissipating member **80** is stably fixed without moving by the sealing member **40**.

In the rechargeable battery **106**, the three heat dissipating portions **81***b*, **81***c*, and **81***d* are formed in the heat dissipating

member **80** for easily emitting heat that is absorbed in the heat collecting portion **81***a*, and heat dissipating performance is thereby improved.

FIG. **11** is a cross-sectional view of a rechargeable battery according to another exemplary embodiment of the present invention. Referring to FIG. **11**, a rechargeable battery **107** according to an exemplary embodiment is formed having the same structure as the rechargeable battery **106** described above, except for a structure of a heat dissipating member **90**, and therefore a detailed description of the same or similar components thereof will be omitted.

The heat dissipating member **90** according to one exemplary embodiment includes a metal plate **91** and an interception layer **92** that is inserted into an electrode assembly **15** of the rechargeable battery **107** and that encloses the metal plate **91**. The electrode assembly **15**, in one embodiment, is a stacked electrode assembly in which a plurality of positive electrodes and a plurality of negative electrodes are stacked with separators interposed therebetween. The metal plate **91** includes a heat collecting portion **91***a* that is positioned within the case **25** and that is formed having an approximately quadrangular plate structure, and a heat dissipating portion **91***b* that is protruded from the heat collecting portion **91***a* and exposed to the outside of the case **25**.

The heat dissipating portion **91***b*, in one embodiment, is protruded from a surface in which the terminals **21** and **22** are not installed in the case **25**, and the terminals **21** and **22** are protruded to one side of the case **25**, and the heat dissipating portion **91***b* is protruded to three other sides of the case **25**. The heat dissipating portion **91***b* is connected and protruded along three sides of the heat collecting portion **91***a* and is protruded from an entire first side surface of the heat collecting portion **91***a* that is opposite a side of the case **25** from which the terminal **21** and **22** protrude, and is protruded from portions of two side surfaces adjacent, or orthogonal, to the first side surface. Accordingly, the heat dissipating portion **91***b* is formed having a generally U-shaped form.

Further, a sealing member **40** that seals between the case **25** and the heat dissipating portion **91***b* is formed in a region in which the heat dissipating portion **91***b* and the case **25** are overlapped. The sealing member **40**, according to an exemplary embodiment, is formed having the same structure as that of the sealing member **40** described above with respect to the rechargeable battery **101**, and therefore a detailed description thereof will be omitted.

Further, in one embodiment, in the heat dissipating portion **91***b*, a plurality of holes **94** are formed in a portion contacting the sealing member **40**, and the sealing member **40** is inserted into the holes **94**. The holes **94** are separated along a perimeter direction of the case **25** and, thus, the heat dissipating member **90** is stably fixed without moving by the sealing member **40**.

In the rechargeable battery **107**, the heat dissipating portion **91***b* that is formed in the heat dissipating member **90** is connected and protruded to three side surfaces, and heat that is absorbed in the heat collecting portion **91***a* is easily emitted and, thus, heat dissipating performance is improved.

While this disclosure has been described in connection with what are presently considered to be some exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. A rechargeable battery comprising:

an electrode assembly comprising a positive electrode, a negative electrode, and a separator between the positive electrode and the negative electrode;

a case housing the electrode assembly;

a heat dissipating member comprising a heat collecting portion inserted in the electrode assembly and a heat dissipating portion protruding outside of the case; and

a sealing member between the heat dissipating member and the case, the sealing member comprising a first polymer layer and a second polymer layer having a melting point that is lower than a melting point of the first polymer layer.

2. The rechargeable battery of claim **1**, wherein the electrode assembly has a spiral-wound structure, and the heat dissipating member is inserted in a center of the electrode assembly.

3. The rechargeable battery of claim **1**, wherein the heat dissipating member has a hole formed in a portion contacting the sealing member.

4. The rechargeable battery of claim **3**, wherein a portion of the sealing member is in the hole.

5. The rechargeable battery of claim **1**, wherein the second polymer layer comprises polypropylene.

6. The rechargeable battery of claim **1**, wherein the second polymer layer comprises a first sealing layer comprising polypropylene and a second sealing layer comprising cast polypropylene.

7. The rechargeable battery of claim **1**, wherein the first polymer layer and the second polymer layer are stacked.

8. The rechargeable battery of claim **1**, wherein the sealing member further comprises a third polymer layer having a melting point that is lower than the melting point of the first polymer layer, and the first polymer layer is between the second polymer layer and the third polymer layer.

9. The rechargeable battery of claim **8**, wherein the third polymer layer comprises a third sealing layer comprising polypropylene and a fourth sealing layer comprising cast polypropylene.

10. The rechargeable battery of claim **9**, wherein the fourth sealing layer is between the third sealing layer and the first polymer layer.

11. The rechargeable battery of claim **1**, wherein the first polymer layer comprises an imide-based resin.

12. The rechargeable battery of claim **1**, wherein the first polymer layer comprises a material selected from the group consisting of polyimide, polyamideimide, polyetherimide, and polybismaleimide.

13. The rechargeable battery of claim **1**, wherein the melting point of the first polymer layer is at least 20° C. higher than the melting point of the second polymer layer.

14. The rechargeable battery of claim **1**, wherein the sealing member is hot pressed.

15. The rechargeable battery of claim **1**, wherein the heat dissipating member comprises a metal plate.

16. The rechargeable battery of claim **1**, wherein the heat dissipating member further comprises an interception layer covering a surface of the heat collecting portion.

17. The rechargeable battery of claim **1**, further comprising a terminal protruding outside of the case in a first direction, wherein the heat dissipating portion is protruding outside of the case in a different direction than the first direction.

18. The rechargeable battery of claim **1**, wherein the heat dissipating portion is a first heat dissipating portion, and the heat dissipating member further comprises a second heat dissipating portion protruding outside of the case in a direc-

tion opposite a direction in which the first heat dissipating portion is protruding outside of the case.

19. The rechargeable battery of claim **18**, wherein the heat dissipating member further comprises a third heat dissipating portion protruding outside of the case in a direction intersecting the directions in which the first and second heat dissipating portions are protruding outside of the case.

20. The rechargeable battery of claim **1**, wherein the heat dissipating portion is connected to and protruding outside of the case along three surfaces of the case.

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